DEPARTMENT OF ENERGY
Nevada Operations Office
Las Vegas, NV

DOE ORDER 232.1

TRENDING & ANALYSIS

REPORT

Fourth Quarter

1996

TABLE OF CONTENTS

INTRODUCTION

This Department of Energy, Nevada Operations Office (DOE/NV) Quarterly Trending & Analysis Report (QT&AR) covers the fourth quarter of 1996. The DOE/NV QT&AR includes data from the Occurrence Reporting and Processing System (ORPS) calendar quarter, which ended December 31, 1996.

The DOE/NV QT&AR is based on DOE/NV ORPS reports issued under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information* and its earlier versions. This report consists of a management summary and statistical data on occurrences reported by DOE/NV and its contractors/users. Also, included are items of interest from events occurring at other DOE locations.

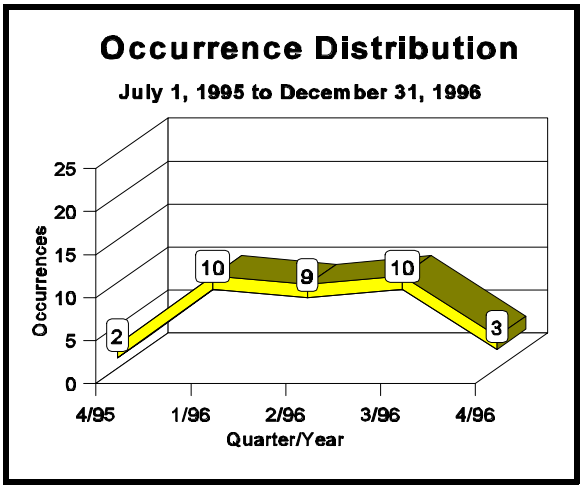
Not all of the 18 DOE/NV contractors/users registered in ORPS as Facility Managers (FMs) for DOE/NV's 73 facilities, will appear in this report. The QT&AR includes only the DOE/NV contractors/users who submitted occurrence reports in ORPS.

Effective this quarter, the abbreviation for Bechtel Nevada is BNLV (previous abbreviation BNOO) and the abbreviation for Wackenhut Services, Inc. is WSIN (previous abbreviation WSIO). The Defense Special Weapons Agency (DSWA) replaces the Defense Nuclear Agency (DNAO). The abbreviations (recognized by ORPS) for the DOE/NV contractors/users appearing in this report follow:

BNLV	Bechtel Nevada
DSWA	Defense Special Weapons Agency
GONV	Nevada Operations Office
ITNV	IT Corporation
LANV	Los Alamos National Laboratory - Nevada
LLNV	Lawrence Livermore National Laboratory - Nevada
SDNL	Sandia National Laboratory, Nevada
WSIN	Wackenhut Services, Inc.

MANAGEMENT SUMMARY

This section summarizes general trends, observations, and lessons learned during the compilation, evaluation, and reporting of occurrences for this quarter. Three new reports for this quarter were identified from ORPS based on the occurrence discovery date.



Occurrences by Contractor
August 1, 1990 to December 31, 1996

BNLV		DSWA		GONV		ITNV		LANV		LLNV		SDNL		WSIN	
Total	Qtr	Total	Qtr	Total	Qtr	Total	Qtr	Total	Qtr	Total	Qtr	Total	Qtr	Total	Qtr
19	6	2	0	7	1	1	0	3	0	14	1	4	0	62	1

Emergency

DOE/NV has never categorized an event as an "Emergency" since the implementation of ORPS.

Unusual Occurrence

DOE/NV categorized one event as an Unusual Occurrence (UO) this quarter. The UO was reported under the Safeguards/Security ORPS reporting area.

DOE/NV has reported a total of 54 occurrences as UOs since the implementation of ORPS. They were reported under the following ORPS reporting areas: Safeguards/Security at 50 percent, Environmental at 23 percent, Facility Condition at 12 percent, Personnel Safety at 7 percent, Facility Status at 4 percent, Value Basis Reporting at 2 percent, and Cross-Category Items at 2 percent. **Occurrences can and have been reported under more than one ORPS reporting area.**

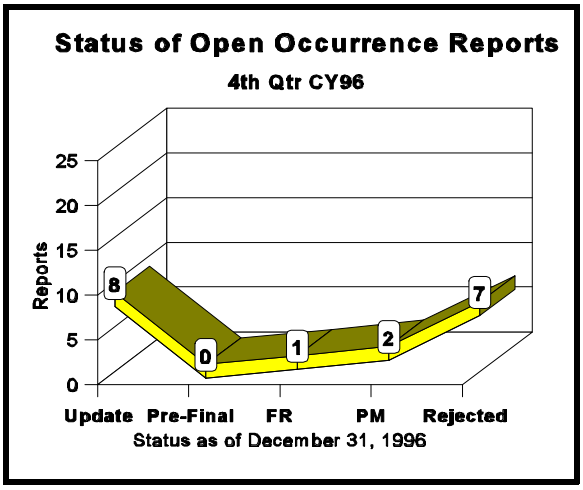
Off-Normal Occurrence

DOE/NV categorized two events as Off-Normal Occurrences (ONs) this quarter. They were reported under the following ORPS reporting areas: one under Facility Condition and one under Value Basis Reporting.

DOE/NV has reported a total of 592 occurrences as ONs since the implementation of ORPS. They were reported under the following ORPS reporting areas: Facility Condition at 31 percent, Environmental at 21 percent, Personnel Safety at 15 percent, Safeguards/Security at 10 percent, Cross-Category Items at 10 percent, Personnel Radiation Protection at 5 percent, Value Basis Reporting at 3 percent, Transportation at 2 percent, and Facility Status at 2 percent.

TRENDING AND ANALYSIS

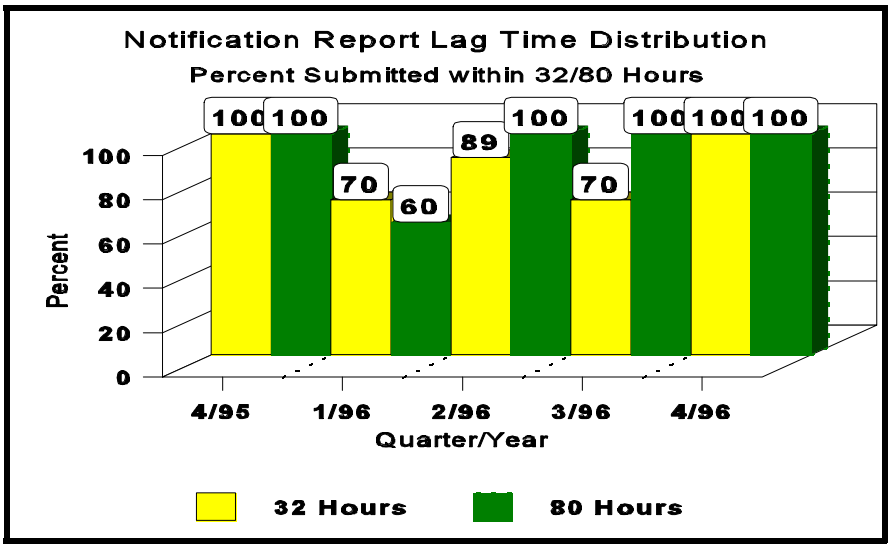
Since the implementation of ORPS, DOE/NV has reported a total of 646 occurrence reports. As of December 31, 1996, 628 occurrence reports have been finalized. Of the eighteen reports that remain open, eleven are in the process of being completed and seven have been rejected pending further action.



REPORT TIMELINESS

Notification Reports

DOE Order 232.1 requires that a Notification Occurrence Report (NOR) be submitted before the close of the next working day from the time of categorization (not to exceed 80 hours). During this quarter, DOE/NV and its contractors/users submitted 100 percent of the NORs by the close of the next business day and 100 percent of the three NORs were reported within the 80 hour criteria.



Notification Report Lag Time
4th Qtr CY96

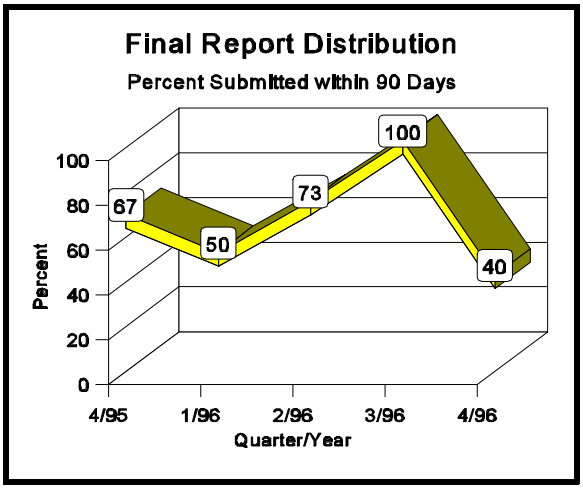
HOURS	0-5	6-10	11-15	16-20	21-25	26-30	30+
REPORTS	0	0	0	1	2	0	0

Update Reports

An Update Occurrence Report (UOR) is to be completed by the FM when significant and new information is available or upon request by DOE/NV. A UOR will be submitted within 45 days after categorization if the required analysis of an event cannot be completed. The report will explain the delay and provide an estimated date for submittal of the Final Occurrence Report (FOR).

Final Reports

A FOR is to be completed by the FM and submitted to the FR when practical, but within 45 calendar days after categorization. The FR will review, approve, add any comments, and forward the FOR to the PM within 10 calendar days of receipt. The PM will review, approve, and add any comments to the FOR within 14 days of receipt. If the FOR is not approved by either the FR or the PM, they will return it to the FM with an explanation for the disapproval. A FOR is considered final when the FM, FR, and/or PM have all approved and signed the report.



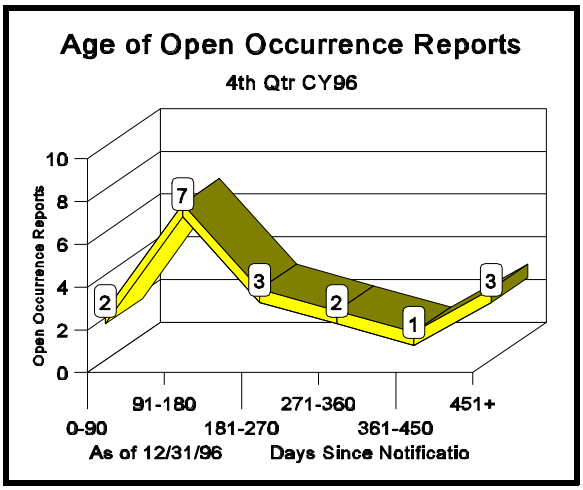
DOE Order 232.1 establishes a 45-calendar day criterion for completion of FORs by the FM. DOE/HQ established an internal goal that 90% of reports should meet the 45-day criteria. The Defense Programs Occurrence Analysis Report, published quarterly to compile all Defense Programs reporting, uses a 90-day deadline as a reference target. The QT&AR follows that criterion here for comparative purposes. Analysis of data for this quarter shows a decrease from the fourth quarter a year ago and a decrease from the preceding quarter. Five FORs were submitted during this quarter with an average of 296 days. Two of the FORs met the 90-day criteria and one met the 45-day criteria.

Final Report Lag Time
4th Qtr CY96

DAYS	0-15	16-30	31-45	46-60	61-75	76-90	90+
REPORTS	1	0	0	0	1	0	3

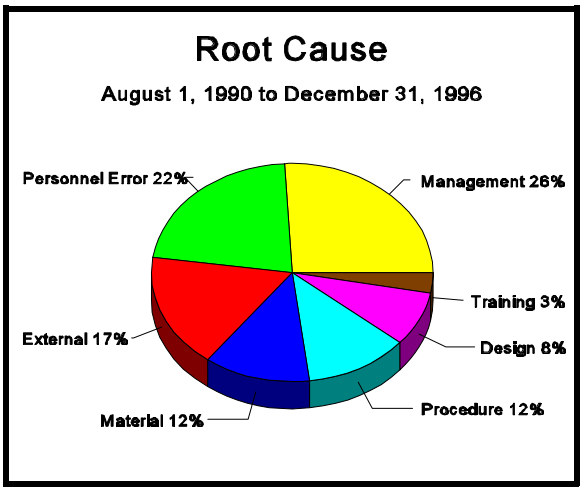
Backlog of Open Occurrence Reports

As of December 31, 1996, DOE/NV had a total of eighteen open occurrence reports. Sixteen reports have been open longer than 90 days. Three reports, still in the pre-final stage, have been open more than 500 days. Seven of the open occurrence reports are rejected and awaiting further action. The remaining eleven open occurrence reports are awaiting an update or pre-final action.



ROOT CAUSE ANALYSIS

Since the implementation of ORPS, DOE/NV and its contractors/users have reported 640 root causes. Management Problem dominates the root causes at 26 percent. The subgroups identified most often are 1) Inadequate Administrative Control and 2) Policy Not Adequately Defined, Disseminated, or Enforced.

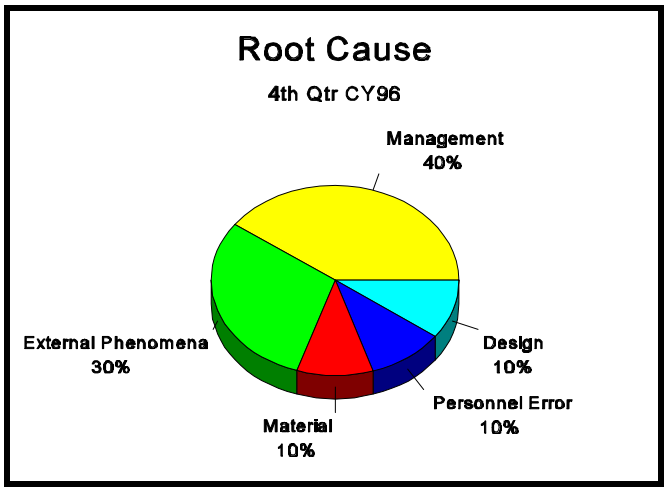


Personnel Error dominates at 22 percent. The three subgroups identified most often are 1) Inattention to Detail, 2) Procedure Not Used or Used Incorrectly, and 3) Other Human Error.

The other predominant root cause is External Phenomena at 17 percent. The subgroups identified most often are
1) Weather or Ambient Condition and
2) Theft, Tampering, Sabotage, Vandalism.

The remaining reported root causes are Equipment/Material at 12 percent, Procedure Problem at 12 percent, Design Problem at 8 percent, and Training Deficiency at 3 percent.

The trend for the ten root causes reported this quarter differs slightly from the total analysis. Management Problem dominates at 40 percent. The other predominant root cause is External Phenomena at 30 percent. Equipment/Material Problem, Personnel Error, and Design Problem were each reported at 10 percent.

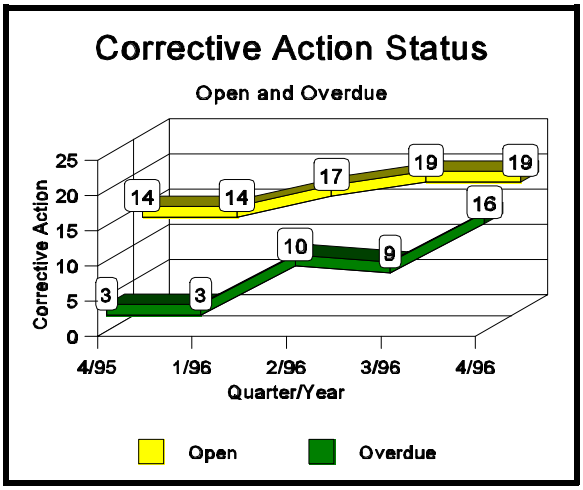


Root Cause Distribution
Breakdown by Category

Material		Procedure		Personnel		Design		Training		Management		External		Other	
Total	Qtr	Total	Qtr	Total	Qtr	Total	Qtr	Total	Qtr	Total	Qtr	Total	Qtr	Total	Qtr
78	1	79	0	142	1	50	1	16	0	166	4	105	3	4	0

CORRECTIVE ACTIONS

As of December 31, 1996, DOE/NV had nineteen open corrective actions. Sixteen open corrective actions are overdue. Note that because revised target completion dates are included each quarter, comparisons between quarterly corrective action status data are not meaningful. The distribution of actions changes whenever the status is updated.



This quarter shows a sharp increase in overdue corrective actions. The following table includes the occurrence report number, the corrective action number, and the number of days the corrective action is overdue. Update and/or close out these overdue corrective actions. If instructions are needed to update and/or close out the

overdue corrective actions, contact the Emergency Operations Center (EOC) personnel at 295-1422 or Debi Binder at 295-6351.

Occurrence Report	Corrective Action	Days Overdue
NVOO--BNOO-NTS-1996-0002	02	199
NVOO--BNOO-NTS-1996-0003	01 02	244 230
NVOO--BNOO-NTS-1996-0004	02	166
NVOO--GONV-ESMW-1994-0001	01	30
NVOO--REEC-ADMN-1994-0001	03	275
NVOO--REEC-EHDO-1991-1008	01	138
NVOO--REEC-EHDO-1992-0017	03	92
NVOO--REEC-EMD2-1994-0001	02	276
NVOO--REEC-EMDO-1994-0002	01 02	276 244
NVOO--REEC-EMDO-1995-0002	01 02	396 396
NVOO--REEC-EMDO-1995-0004	01 02	30 30
NVOO--REEC-OMDO-1994-0007	01	366

NEW PROCEDURE FOR SUBMITTING DRAFT OCCURRENCE REPORTS

A new procedure allows the FM to submit draft occurrence reports to the EOC by E-mail. The E-mail address for the EOC is EOC@nv.doe.gov

The procedure to submit a draft occurrence report by E-mail to the EOC follows: 1) select the appropriate occurrence report from the PC ORPS program, 2) select the Print Option, 3) select Print to File, and 4) attach the file to the E-mail. Remember to give the file a “wpd” extension. Address any questions to the EOC personnel at 295-1422 or Debi Binder at 295-6351.

DOE/NV OCCURRENCE REPORTS

verbatim from DOE/NV occurrence reports

Three events were categorized under ORPS for this quarter, one as a UO and two as ONs. Address any questions or comments regarding these events to Debi Binder at 295-6351 or the EOC personnel at 295-1422. A description of occurrence for each event follows.

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Inadvertent Unauthorized Entry into Locked Facilities (NVOO--GONV-GONV-1996-0001)

Description of Occurrence: On October 28, 1996, Professional Analysis, Inc./Bechtel Nevada (PAI/BN) personnel doing facility surveys at the Nevada Test Site (NTS) requested authorization to enter Building 11-101 in the Tweezer Compound in Area 11. DOE Security personnel gave Wackenhut Services, Inc. Security personnel permission to access the compound. A lock on a bunker containing ordinance belonging to the Defense Special Weapons Agency (DSWA) was cut and PAI/BN personnel entered the bunker. The next morning DSWA personnel inventoried the contents of the bunker and accounted for all materials. The security of the bunker was not degraded except to the extent of a team member entering and inventorying the contents.

On October 29, 1996, PAI/BN personnel doing facility surveys at the NTS entered Building 11-4 in the Tweezer Compound, which was being used for storage of debris from a 1991 helicopter crash at the NTS. These parts have been crated and are being preserved due to ongoing legal issues regarding the accident. Entry into the building has inadvertently compromised the chain of custody rules for evidence. At this point in

time DOE/NV Chief Counsel does not see that this compromise of the storage facility will affect future litigation issues.

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Single Vehicle Accident with no Injuries (NVOO--LLNV-LLNV-1996-0001)

Description of Occurrence: On October 15, 1996, at approximately 1300 hours, a Lawrence Livermore National Laboratory (LLNL) employee was driving a government owned vehicle on the X Tunnel access road that is on the Nevada Test Site. This is a gravel road. The employee was alone in the vehicle at the time. He was wearing his seat belt. He swerved to miss a large rock in the road, encountered soft sand on the shoulder of the road, and was unable to return to the roadway before striking several other large rocks at the side of the road.

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Demonstration/Protest (NVOO--WSIN-NTS2-1996-0001)

Description of Occurrence: On Monday, October 14, 1996, at approximately 1100 hours, a demonstration was held by approximately 65 personnel at the entrance to the Nevada Test Site (NTS), cattle guard in Area 22. Members of the protest group were affiliated with the Nevada Desert Experience, Healing Global Wounds, and the Shoshone Indian Nation. The demonstrators blocked the entrance to the NTS and traffic entering the site was diverted to Old Mercury Highway then. The main entrance (Mercury Highway) was reopened at 1156 hours. Twenty-two personnel were arrested for trespassing, cited, and released. There were no injuries reported. All demonstrators departed the area at approximately 1300 hours.

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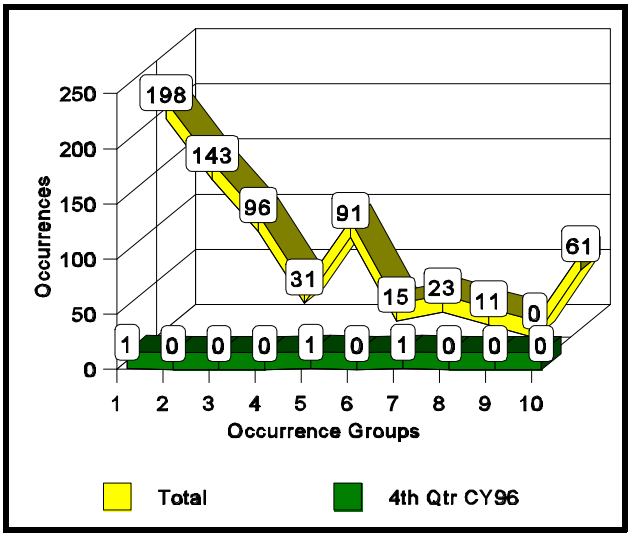
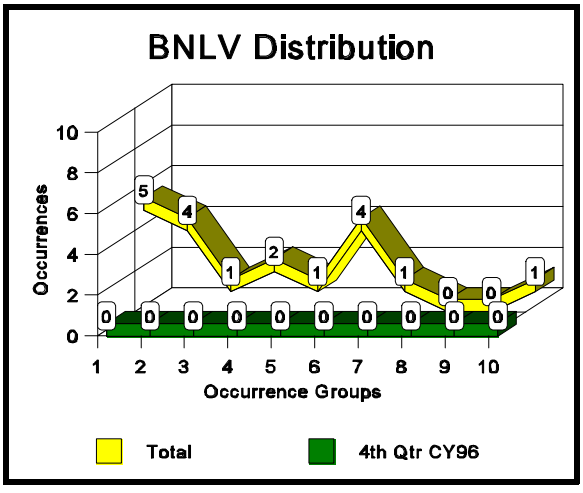
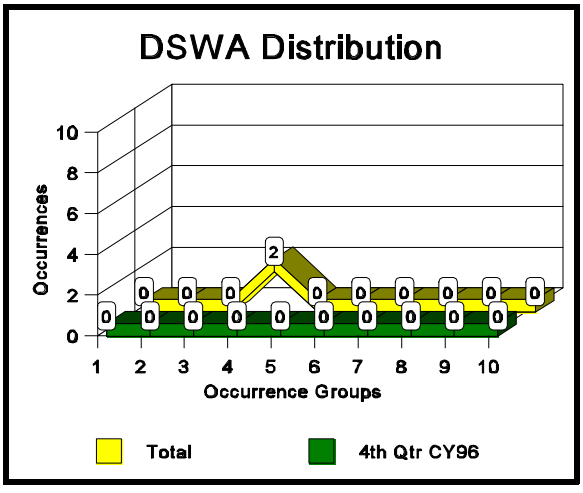
DISTRIBUTION OF CATEGORIES

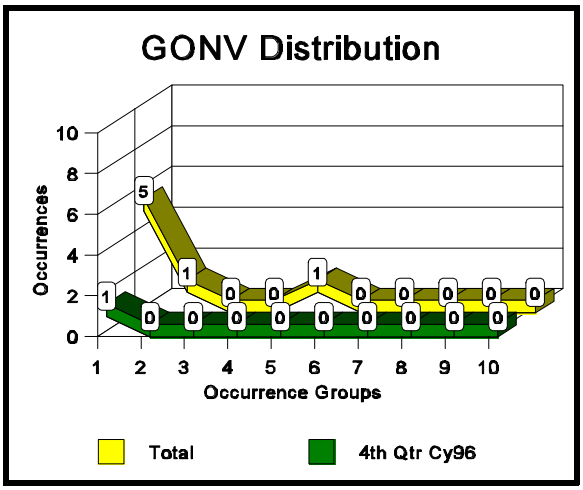
Distribution of Categories
August 1, 1990 to December 31, 1996

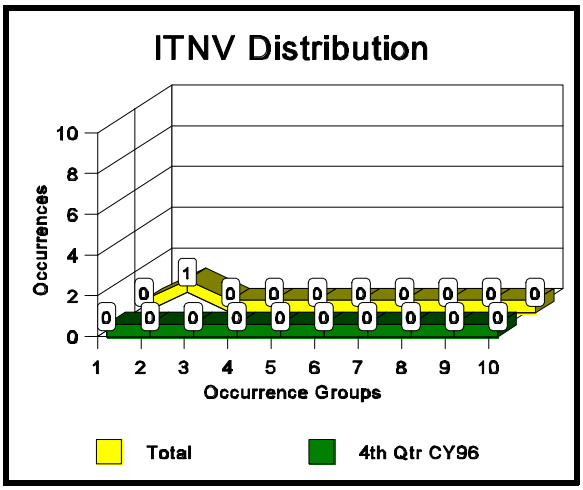


Occurrence Group-Codes : 1 = Facility Condition; 2 = Environmental; 3 = Personnel Safety; 4 = Personnel Radiation Protection; 5 = Safeguards and Security; 6 = Transportation; 7 = Value Basis Reporting; 8 = Facility Status; 9 = Nuclear Explosive Safety; 10 = Cross-Category Items. ***Occurrences may be reported under more than one Occurrence Group Code.***









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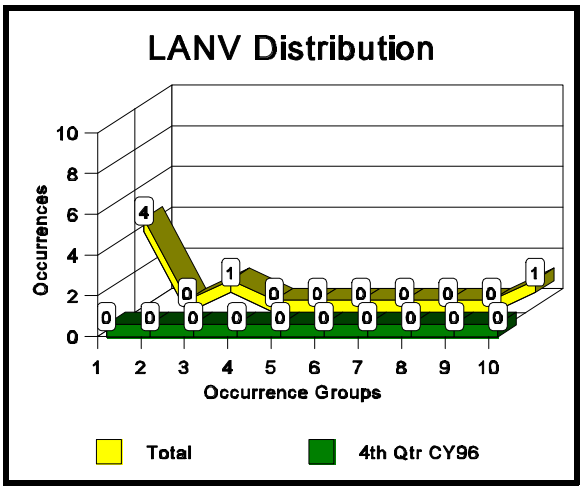

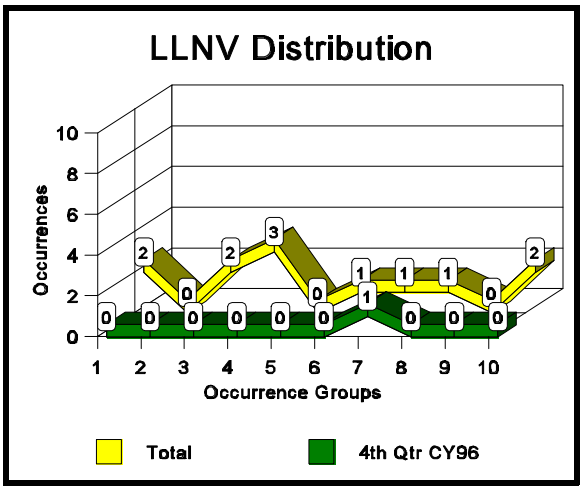

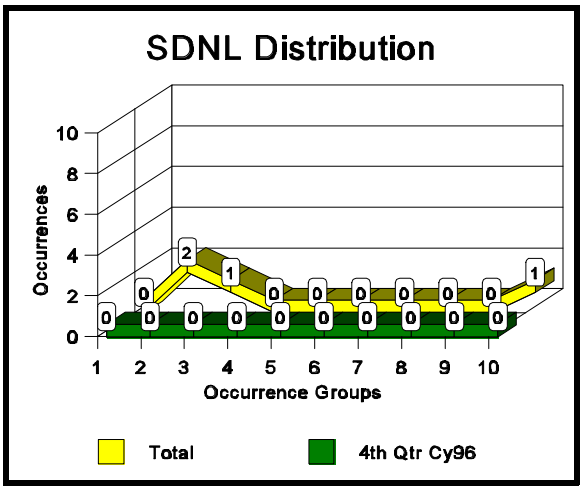

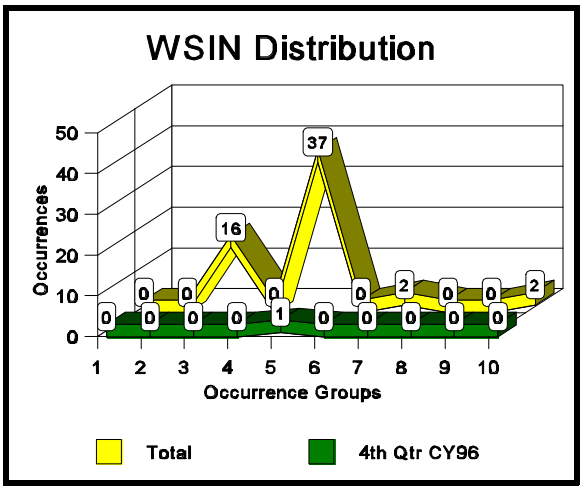

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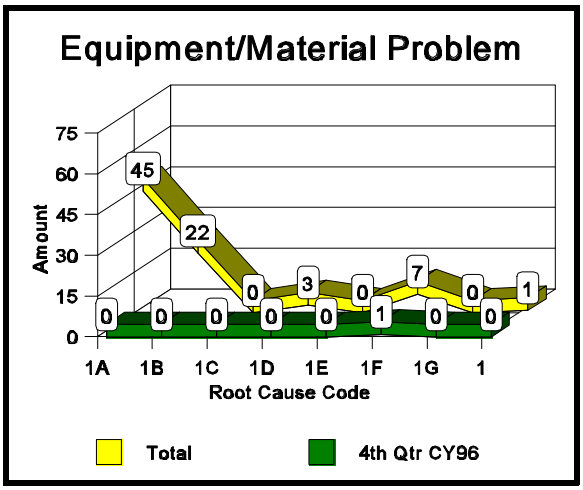
ROOT CAUSE CODES AND DEFINITIONS

EquipmentIMaterial Problem: An event or condition resulting from the failure, malfunction, or deterioration of equipment or parts, including instruments or material.



1A. ***Defective or Failed Part:*** A part/instrument that lacks something essential to perform its intended function.

1B. ***Defective or Failed Material:*** A material defect or failure.

1C. ***Defective Weld, Braze, or Soldered Joint:*** A specific weld/joint defect or failure.

1D. ***Error by Manufacturer in Shipping or Marking:*** An error by the manufacturer or supplier in the shipping or marking of equipment.

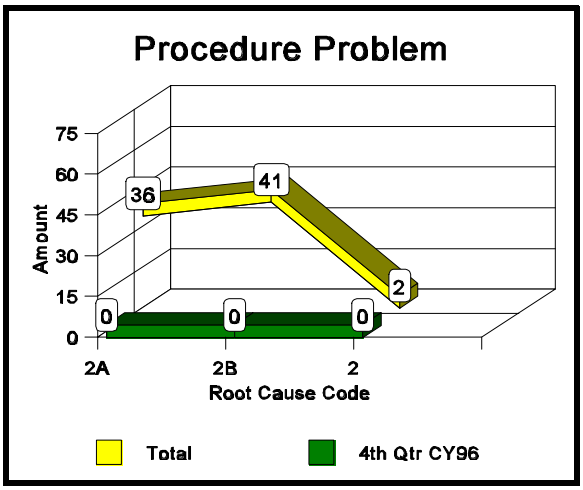
1E. ***Electrical or Instrument Noise:*** An unwanted signal or disturbance that interferes with the operation of equipment.

1F. ***Contaminant:*** Failure or degradation due to radiation damage or foreign material such as dirt, crud, or impurities.

1G. ***End of Life Failure:*** A failure where the equipment or material is run to failure and has reached its end of design life.

1. Equipment/Material Problems reported prior to 4/1/91.

Procedure Problem: An event or condition that can be traced to the lack of a procedure, an error in a procedure, or a procedural deficiency or inadequacy.

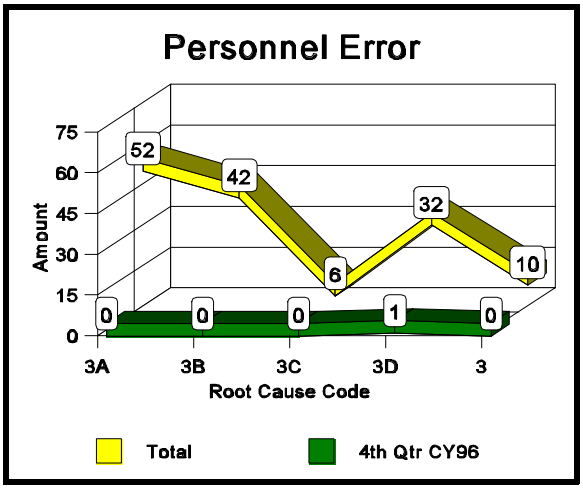


2A. ***Defective or Inadequate Procedure:*** A procedure that either contains an error or lacks something essential to the successful performance of the activity.

2B. ***Lack of Procedure:*** No written procedure was in place to perform the activity.

2. Procedure Problems reported prior to 4/1/91.

Personnel Error: An event or condition due to an error, mistake, or oversight.



3A. ***Inattention to Detail:*** Inadequate attention to the specific details of the task.

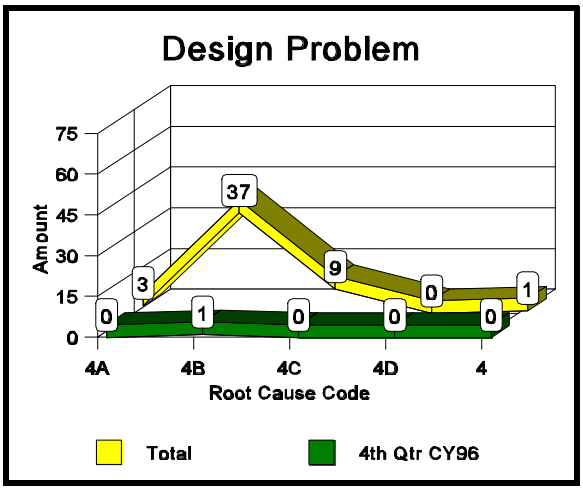
3B. ***Procedure Not Used or Used Incorrectly:*** The failure to use or the inappropriate use of written instructions, procedures, or other documentation.

3C. ***Communication Problem:*** Inadequate presentation or exchange of information.

3D. ***Other Human Error:*** Human error other than those described above.

3. Personnel Errors reported prior to 4/1/91.

Design Problem: An event or condition that can be traced to a defect in design or other factors related to configuration, engineering, layout, tolerances, calculations, etc.



4A. ***Inadequate Work Environment:*** Inadequate design of equipment used to communicate information from the facility to a person (e.g., displays, labels, etc.) as well as inadequate work environment, such as inadequate lighting, working space, or other human factor considerations.

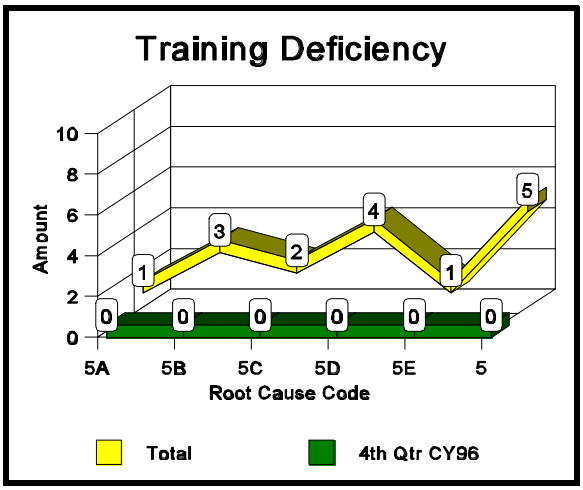
4B. ***Inadequate or Defective Design:*** A design in which something essential was lacking (defective) or when a detail was included but was not adequate for the requirement (inadequate).

4C. ***Error in Equipment or Material Selection:*** A mistake in the equipment or material selection only, not to include a procurement error (see Personnel Error (d) Other Human Error) or a specification error (see Design Problem - (d) Drawing, Specification, or Data Errors).

4D. ***Drawing, Specification, or Data Errors:*** An error in the calculation, information, or specification of a design.

4 . Design Problems reported prior to 4/1/91.

Training Deficiency: An event or condition that can be traced to a lack of training or insufficient training to enable a person to perform a desired task adequately.



5A. ***No Training Provided:*** A lack of appropriate training.

5B. ***Insufficient Practice or Hands-On Experience:*** An inadequate amount of preparation before performing the activity.

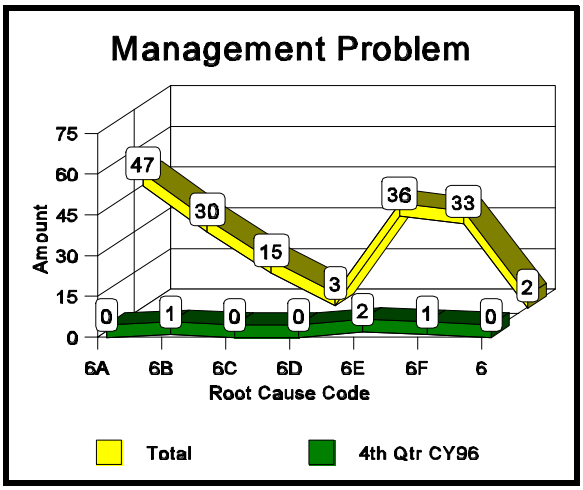
5C. ***Inadequate Content:*** The knowledge and skills required to perform the task or job were not identified.

5D. ***Insufficient Refresher Training:*** The frequency of refresher training was not sufficient to maintain the required knowledge and skills.

5E. ***Inadequate Presentation or Materials:*** The training presentation or materials were insufficient to provide adequate instruction.

5. Training Deficiencies reported prior to 4/1/91.

Management Problem: An event or condition that can be directly traced to managerial actions or methods.



6A. ***Inadequate Administrative Control:*** A deficiency in the controls in place to administer and direct activities.

6B. ***Work Organization/Planning Deficiency:*** A deficiency in the planning, scoping, assignment, or scheduling of work.

6C. ***Inadequate Supervision:*** Inadequate techniques used to direct workers in the accomplishment of tasks.

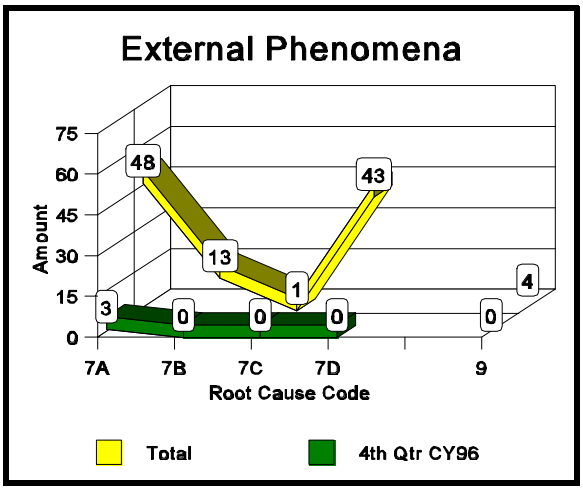
6D. ***Improper Resource Allocation:*** Improper personnel or material allocation resulting in the inability to successfully perform assigned tasks.

6E. ***Policy Not Adequately Defined, Disseminated, or Enforced:*** Inadequate description, distribution, or enforcement of policies and expectations.

6F. ***Other Management Problem:*** A management problem other than those defined above.

6. Management Problems reported prior to 4/1/91.

External Phenomena: An event or condition caused by factors that are not under the control of the reporting organization or the suppliers of the failed equipment or service.



7A. ***Weather or Ambient Condition:*** Unusual weather or ambient conditions, including hurricanes, tornadoes, flooding, earthquake, and lightning.

7B. ***Power Failure or Transient:*** Special cases of power loss that are attributable to outside supplied power.

7C. ***External Fire or Explosion:*** An external fire, explosion, or implosion.

7D. ***Theft, Tampering, Sabotage, or Vandalism:*** Theft, tampering, sabotage, or vandalism that could not have been prevented by the reporting organization.

Radiological/Hazardous Material Problem: An event related to radiological or hazardous material contamination that cannot be attributed to any of the other causes.

8A. ***Legacy Contamination:*** Radiological or hazardous material contamination attributed to past practices.

8B. ***Source Unknown:*** Radiological or hazardous material contamination where the source cannot be reasonably determined.

Note: There have been no occurrences classified with this root cause for this quarter or any other quarters.

9. Other problems reported prior to 4/1/91.

GENERAL CHECKLIST FOR FINAL OCCURRENCE REPORT REVIEW

excerpts from the DOE Lessons Learned Information Services

1. Does the Description of Occurrence (16) contain all of the following?

    a) The Description of Occurrence (16) contains a clear, factual, logical flow of information.

    b) There is an explanation of abbreviations, acronyms, and site-specific terms.

    c) The detail provided is graded to reflect the relative importance of the incident.

    d) The Description of Occurrence (16) contains the method of discovery and, if appropriate, the sequence of events to show the logical progression of the occurrence.

    e) There is an explanation of any personnel errors involved or procedure problems encountered.

    f) The response of safety systems and signals and any loss of safety equipment is identified.

    g) The operation actions that affected the course of the event are defined.

    h) There is an explanation of any component failure, failure modes, and duration of any failures.

    i) If the occurrence involved any equipment failure cases, is the equipment properly identified with the manufacturer, model number, size, etc.?

    j) If it is appropriate to the occurrence, are photos, sketches, or drawings attached?

    k) A brief description of the function/purpose of the facility is included.

2. For the Description of Cause (23), is there a logical relationship to the Description of Occurrence (16)?

3. Root Cause Analysis - Do the direct (20), contributing (21), and root (22) causes refer to the basic underlying conditions that led to the occurrence?

Is there a logical relationship between the cause codes and the Description of Cause (23)?

Is the method used for the root cause analysis identified?

4. Corrective Actions (26) - Do the corrective actions address the cause(s) identified in fields 20-22?

   Can they be accomplished? Are they committed to be done in a reasonable time?

   Have they been scheduled? Is there a name or department listed for responsibility?

5. After reading the complete report do you really understand what happened, including the significance of what happened, the cause, and the corrective actions?

LESSONS LEARNED

excerpts from the DOE Lessons Learned Information Services

The following section discusses selected final reports that go beyond the minimum requirements of DOE Order 232.1 in providing lessons learned worth distribution to the DOE community.

Employee Receives Injury When Hit by Forklift

Lessons Learned Statement: Backup alarms on industrial equipment are not always sufficient in and of themselves to prevent accidents and injuries. Industrial equipment drivers/operators must be totally aware of others who are working in the same area.

Discussion: On May 6, 1996, an operator, working inside a rail boxcar, was struck by a forklift while recording data for a rail shipment. The operator was recording identification numbers on waste drums inside a rail car within a work area of 18 feet by 9 and 1/2 feet. The operator, who usually recorded numbers after the car was loaded, decided to record the numbers as the car was being loaded to avoid climbing on top of the drums. The operator did not tell the forklift driver that he would be in the car. The forklift driver backed into the car not realizing the operator was working in the car, and not able to see the operator, struck the operator's ankle. The accident caused a crushing injury to the employee's ankle and resulted in a lost workday case.

Analysis: Because of this accident all operations were suspended, an investigation was initiated, and actions were taken to prevent further accidents. The first action taken was to prohibit anyone from being in the boxcar while it is being loaded, except a spotter who will only be present for loading the last section of the boxcar. A chain barrier was put in place to physically prevent forklift drivers from entering the boxcar when other workers are present. All personnel who work this operation were assembled and instructed on the new procedure.

Recommended Actions: 1) All workers should communicate with the operators of moving industrial equipment so that each is aware of the other's presence in the work space. 2) Work plans or procedures should contain engineering controls such as physical barriers to minimize or prevent personnel from being struck by moving industrial equipment.

Awareness of Fall Protection Hazards

Lessons Learned Statement: Failure to follow appropriate fall protection requirements can result in serious injuries. According to the National Safety Council, "falls" are the second leading cause of accidental deaths in the United States.

Discussion: A subcontractor working on an elevated work platform fell approximately 45 feet to his death. The subcontractor was replacing bolts on a structure in the aircraft assembly building at the plant site. While replacing one of the bolts, he apparently lost his footing and fell from the platform. The platform was one constructed some years ago and was fitted on an overhead crane. The platform had provisions for guard rails, but the rails were not in use at the time of the accident. Four individuals were on the platform at the time of the accident, including the supervisor. Two of the individuals wore the appropriate fall protection equipment, but the other two, including the victim, did not.

Analysis: Preliminary reviews show that the fatality could have been avoided had the appropriate guard railing been in place and the appropriate personal protection equipment worn.

Recommended Actions: Employers must take preventive action whenever a worker is exposed to a fall of four feet or more (in construction the threshold is normally six feet). Guardrails are the most common form of fall protection systems. Safety nets, personal fall-restraint or fall-arrest systems, or another demonstrated, effective means of fall protection may be used when guardrail systems are not feasible.

Supervisors must ensure all employees, including subcontractors, are not exposed to unsafe working conditions. All employees are reminded that they must comply with all requirements to ensure a safe work environment during all operations.

Day Shift Mopping Leads to Slip and Fall Incident

Lessons Learned Statement: Changes in a shift schedule of the janitorial staff from evening shift to day shift presents additional risk for slip and fall hazards.

Discussion: On September 24, 1996, a K-25 Site employee was going to the coffee area to obtain a cup of coffee. As she stepped onto the linoleum tiled floor she slipped and fell. This fall resulted in a lost work time incident.

Analysis: The investigation revealed the direct cause of this incident was the floor was wet due to damp mopping by the janitorial staff. The change analysis revealed the janitorial staff had been mopping during the evening hours when no employees were present, now the mopping is being done on day shift when personnel are present. A contributing factor was that the janitor failed to provide signs at the location where the mopping had just occurred.

Recommended Actions: All mopping activities, except those required by OSHA, have been curtailed. Additionally, signs have been provided to caution personnel to floor conditions. Employees are reminded to use caution when walking in areas identified as wet.

Four Die in Non-DOE Confined Space

Lessons Learned Statement: The incident described below is a graphic representation of improper confined space entry procedure and its catastrophic results. As is often the case in confined space fatalities, there were multiple deaths. In this instance casualties two, three, and four appear to have resulted from those outside the space entering to help the first in trouble, the second in trouble, and so on.

In many cases where there are multiple deaths, the individuals going in to effect the rescue feel they can hold their breath long enough to pull the downed comrade to safety. This common sense rationalization based on our experience of being able to hold our breath for a minute or so is often a deadly error. Consider the following:

1. When an incident occurs in a confined space (such as an entrant passing out or becoming impaired), the state of the remaining members of the team immediately changes. The level of tension and apprehension

usually increase, respiration and heart rate increase and their bodies begin to consume fuel, including oxygen at a higher rate.

2. Usually entry into a confined space is through a small or constricted opening which requires an additional level of effort to get through.

3. Movement within the confined space may be difficult because of the configuration of the space or impediments such as piping, baffles, etc., and because of the equipment that must be worn.

4. Even if the above is discounted, perhaps the most compelling argument to dispel the rationalization about being able to hold ones breath, relates to what actually occurs physiologically in oxygen deficient atmospheres. If one breathes in while in an atmosphere that is sufficiently deficient in oxygen, not only is oxygen not being taken into the lungs, but much of the residual oxygen present in the lungs or available at the blood-gas interface is depleted almost instantaneously.

5. In addition to oxygen deficiency, it is also imperative to consider other toxic gases that may be present. The incident appears to have been attributed, at least after the initial investigation to oxygen deficiency. Hydrogen sulfide, a common gas found in sewers, has resulted in a number of confined space deaths.

6. There is regulatorily mandated training and safety requirements designed to prevent the scenario that has played out here from occurring. If you have questions about confined space procedures or requirements, contact your project safety and health representative. If you are not trained or do not feel the proper controls are in place, do not even think about entering a confined space.

Discussion: Four workers died by asphyxiation in a sewer manhole at a Navy Atlantic Division construction site. The investigation is ongoing.

Details: The project involved the upgrade/replacement of a sewer pumping station. The contractor prepared a Confined Space Entry Permit for the work. The employee was in process of disconnecting a sewer “bypass” connection in a manhole. The manhole filled with sewage and gasses from the sewer line. The employee was overcome by a lack of oxygen. There were three additional employees stationed at the manhole entrance. Each entered the manhole one-at-a-time, apparently to attempt a rescue. Each was overcome by the sewer gasses and died.

(Navy Safety's Comments)

This is a grisly reminder of the dangers associated with confined spaces. Your first question, of course, is how could this happen? Just remember, asphyxiation (lack of oxygen) is not like what you see in the "John Wayne" movies. You cannot go in unprotected, stagger around awhile, save a couple of lives, then exit coughing and unharmed.

Reality is quite different. Upon your FIRST BREATH you pass-out. If you do not have a retrieval system in place or attendants at the confined space entrance with supplied oxygen tanks to allow their entry, YOU DIE! Workers have been found lying on the ground with their head in a sewer manhole. They just stuck their head in to "check it out!", were immediately incapacitated and died.

Recommended Actions: All organizations are encouraged to review this lesson in detail with all employees who deal with confined spaces.

DOE COMPLEX LESSONS LEARNED SUCCESS STORIES

excerpts from the DOE Lessons Learned List Server

Lessons Learned Statement: The following five success stories are possible due to implementation of another DOE site's Lessons Learned that was posted on the List Server. For the four events listed, a total dollar savings is estimated to exceed $1,000,000.

Discussion of Activities: Since the implementation of the DOE Lessons Learned List Server, DOE complex employees have submitted more than 170 items for review and evaluation by other sites for applicability. The following five examples show how the items presented on the List Server can benefit, directly or indirectly, those sites that choose to implement them. Five separate discussions are listed that identify the lessons learned and how it was used at different sites. Actual List Server posting information is included, followed by a short description of the actions taken and an estimate of dollar savings.

Hanford Adopts the Savannah River Site Facility Evaluation Board Process

Employees at the Savannah River Site (SRS) developed a method of performing effective oversight of all areas of facility operations while using fewer personnel to perform this oversight. They accomplished this by consolidating more than twenty environmental, safety, radiological control, and quality assessments into one. The team of employees who perform this oversight, known as the Facility Evaluation Board (FEB), is selected based on their background and level of expertise. The FEB

evaluates a facility in several areas of operations during their review. This eliminates duplication of effort caused by overlapping evaluations performed by different oversight groups at different times, thus minimizing distractions to operations personnel. This system maintains compliance with all DOE independent oversight requirements. Two tiers of oversight are used. The base tier consists of self assessment by division personnel. The upper tier consists of independent oversight of facilities by the FEB. Identical performance objectives and criteria are used by both the facilities in their self assessment and the FEB during their assessment.

This cost saving initiative was placed on the DOE List Server and subsequently forwarded to Quality Assurance and Self Assessment personnel at Hanford. The idea was well received and Hanford management decided to adopt the idea. The documented soft dollar savings* at the SRS is $10,000,000 (> 100 Full Time Equivalent Employees).

The Hanford Site is restructuring its oversite organization. Cost savings information is not available at this time.

* Soft dollar savings allow displaced personnel or resources to be used in other functions or site critical needs, but do not correlate to true hard dollar savings to DOE because no reduction in the operating budget occurred. Soft dollar savings do increase efficiency and provide more value to the customer.

INEL and SRS Discovers Inadequate Inspection of Towers After Sandia Alert

The anchor system of a 60-meter meteorological tower at the Sandia National Laboratories (SNL) failed, causing the tower to fall, which resulted in $20,000 in damage/replacement costs. The cause attributed to the corrosion of galvanized steel rods in the underground section of the tower support system.

Idaho National Engineering Laboratory (INEL) reviewed its periodic maintenance schedule for several radio and meteorological towers. They determined that the inspections were inadequate to ensure avoidance of a tower collapsing due to underground support system failure. Associated inspection procedures were changed to include these inspections. Replacement costs for these towers are estimated to be between $60,000 and $100,000 each, depending on the tower, and assuming no other damage. In addition, the costs of an investigation and occurrence report were avoided. Based on engineering judgement and assumption that one tower support system may fail, total savings is estimated at $60,000 soft dollar savings for one tower and an occurrence report avoidance cost of $3,500 soft dollar savings.

At the Savannah River Site, a review of the policy concerning tower support systems ensures that this event would not happen. However, one department in a laboratory facility evaluated the support systems on a stack and determined that it was subject to similar failure modes. Evaluation of the issue resulted in inspection and replacement of guy wires on the stack. Cost savings were estimated by engineering judgement to be an occurrence report avoidance cost of $3,500 soft dollar savings.

SRS Search Discovers Defective Aerosol Cans After PNL Alert

An Aerodag G aerosol can over pressurized and burst inside a flammable storage cabinet in a laboratory at Pacific Northwest Laboratory (PNL). Safety and research staff members were unable to determine the reason for the can over pressurization.

After being informed of this accident via the DOE List Server, SRS divisions performed searches for this material throughout the site. Thirty-one cans were found in six areas and removed. Cost savings were estimated based on engineering judgement assuming that one of these cans ruptured inside a storage cabinet with no injuries. This rupture would have required an occurrence report to be written; therefore, the removal of this hazard resulted in an occurrence report avoidance cost of $3,500 soft dollar savings.

SRS Laboratory Interpretation of LLNL Lessons Learned Prevents Potential Injury

At Lawrence Livermore National Laboratory (LLNL), a table top centrifuge operating near the upper rotational speed limit, 10,000 rpm, catastrophically failed and injured an experimenter. The centrifuge rotor failed due to the overstress experienced at this speed. The action taken by LLNL was to review manufacturer recommendations for maximum operating limits and stay safely within these limits. The operating speed for the particular centrifuge that failed was recommended to be limited to 5,500 rpm.

After being informed of this accident via the DOE List Server, personnel in the Analytical Development Section at the Savannah River Site determined they did not have any centrifuges of this type, but decided that centrifuges built by different manufacturers could be subject to similar failures. Therefore, all table top centrifuges operations were restricted to half speed or less, which is adequate for most applications. Later, a centrifuge spinning radioactive samples in a radioactive hood failed when the load became unbalanced. The analyst quickly turned off the centrifuge before significant problems occurred. Cost savings were estimated, by engineering judgement, as an avoidance of a potential injury and contamination, contamination cleanup, and generation of an occurrence report. The occurrence report avoidance cost is $3,500 soft dollar savings and the injury/contamination cost avoidance is estimated to be $1,500 soft dollar savings.

Analysis: Use of the DOE Lessons Learned List Server allows different sites to learn from the mistakes, discoveries, and good practices made by others in the DOE complex. Several success stories, noted above, indicate that a broader interpretation of lessons learned information can result in identification of other vulnerabilities and cost avoidances as opposed to a strict interpretation. Some List Server items may be of limited value to all sites, but some lead to greater efficiency in use of resources, cost avoidance/savings, prevention of potential injury, and prevention of equipment damage.

Recommended Actions: Distribute applicable DOE Lessons Learned List Server items to appropriate organizations at your site. Follow up with questions concerning the use of these items as lessons learned material.